

# Rebuttal Arguments for Rule 1.132

Dr. Zbigniew H. Stachurski, PhD. FRACI.

2008 Member of the Advisory Board. Member of the Australian Materials Technology Network. Director of Centre for the Science and Engineering of Materials. Research School of Engineering. Australian National University. Over 100 technical publications and 5 patents in the field of Materials Science and Engineering.

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## 0.1 Description and definition of impact strength of materials.

1. The state, property, or quality of being strong.
2. The power to resist fracture; impregnability.
3. The power to resist strain or stress; durability.

Impact strength of materials and material components is a property which expresses the resistance to deformation and penetration under dynamic impact load.

The work done in fracturing the material under impact loading during a specific test carried out on a specific sample.

A measure of the resiliency or toughness of a material. It can be expressed as a maximum force or energy of a blow (given by a fixed procedure) which can be withstood without fracture, as opposed to engineering fracture strength measured under a slowly increasing applied force.

Impact testing is testing an object's ability to resist high-rate loading. An impact test is a test for determining the energy absorbed in fracturing a test piece at high rate.

For a given method of test, the impact strength is measured either:

- (a) in units of unrecoverable work expanded/dissipated on impact, or
- (b) as the maximum force measured during the impact.

Standard methods of testing for impact strength:

Drop weight impact test: ASTM E208-06, ASTM E680 - 79, ASTM D7136 / D7136M - 07, ASTM D2444, Instron CEAST 9000 Series, etc.

Izod impact testing: ASTM D256.

Charpy impact testing: ASTM A370.

## Characteristics of a high impact strength material or component Preamble

1. The material (or component) will show both elastic and plastic (ductile) deformation before fracture.
2. The stress (load) at which plastic (ductile) deformation is induced is called the flow stress (or load) of the material (or component).

3. By definition, elastic deformation is reversible (recoverable), whereas plastic (ductile) deformation is non-recoverable (dissipative).

### **Characteristics**

1. The plastic ductile deformation of the material (or component) must be larger (10 times or more) than the elastic deformation; for example, expanded metal mesh material (as used in ELACO composites) subjected to extension will show range of plastic deformation far more than 10 times its elastic deformation range.
  2. During plastic (ductile) deformation, the specific work of deformation must be high; for example, expanded metal mesh (as used in ELACO composites) will have much higher specific work of deformation than that of metal wire mesh or corrugated metal foil or corrugated woven cloth.
  3. Specific work of deformation means that the physical work of deformation is referred to the density, or weight, or defined dimensions of the material (or component).
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## **0.2 Unexpected properties/results**

ELACO developed composite materials, incorporating expanded metal mesh, that show unexpectedly high values of impact strength in comparison to a number of other well-known composite materials, including Calfee (US 3,755,059), Brookhart (US 3,989,789) and Hollis (US 3,969,563), as follows:

1. Impact energy absorbed by the ELACO composite material is two to three times greater than that of the other materials, as shown Figure 1.
  2. Such a gross increase in impact energy is an unexpected effect, not obvious to one of ordinary skill in the art at the time of invention. The gross improvement in impact strength is not a mere improvement through practice and better manufacturing technique, but a result of conceptual advancement in the composition of the composite panel.
  3. The judicious combination of components used in making the ELACO composite materials has resulted in unexpected increase in the impact strength properties.
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## **0.3 Describe/define expanded metal mesh component**

An example of the expanded metal mesh is shown in Figure 2. It is a commercially available product.

Expanded metal mesh possesses the property described above as Characteristic 2; that is, its plastic (ductile) deformation on stretching is at least an order of magnitude larger than its elastic deformation.

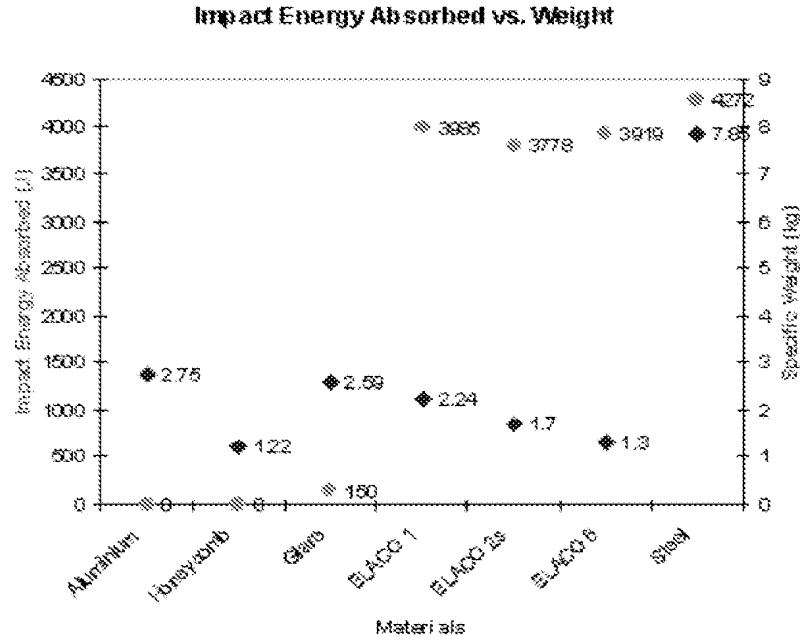


Figure 1: Comparison of impact energy and specific weight of samples of various materials. Red points at upper right corner of the graph, indicating the values of the measured impact energy for the ELACO samples, are compared to the results for other materials shown at the lower bottom of the graph. Specific weight of the materials are shown by the blue points.

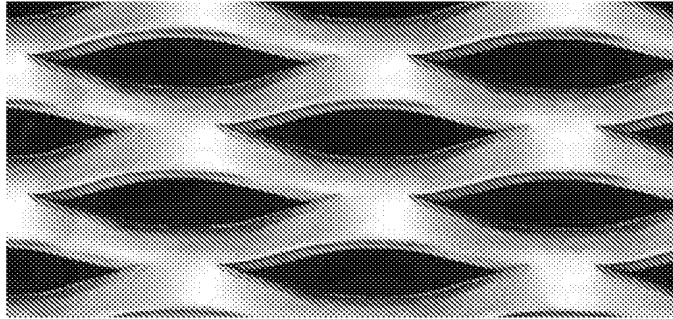


Figure 2: An image of expanded metal mesh similar to the expanded metal mesh used in ELACO composite materials.

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#### 0.4 Obviousness vs. nonobviousness

Improvement in product properties by gradual progression is "obviousness"

Unexpected, gross improvement in properties by conceptual advancement is "nonobviousness"

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## **0.5 Show unobvious differences between claimed product and prior art**

The unobvious differences are:

1. The impact strength higher by a factor of 2 to 3 compared to other composite materials (Calfee, Brookhart, Hollis).
  2. The effect of the higher impact strength is, in part, due to the incorporation of the expanded metal mesh material in the composite panel.
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Z.H. Stachurski  
Canberra, ACT, Australia  
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